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The importance of affectively-laden beliefs about health risks: the case of tobacco use and sun protection

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Abstract

Affect is gaining prominence in health behavior research. However, little is known about the relative influence on behavior of *specific* affectively-laden beliefs about health risks (affective likelihood, worry, anticipated regret), particularly in comparison to cognitive likelihood beliefs. We investigated this issue in relation to two very different cancer-related behaviors. In two prospective studies [tobacco use (N = 1,088); sunscreen use (N = 491)], hierarchical linear and logistic regression analyses revealed that affectively-laden risk beliefs predicted intentions and behaviors more strongly than cognitive likelihood beliefs. Cognitive likelihood contributed independently only for sunscreen use intentions. Smoking-related outcomes were most strongly associated with anticipated regret. Sunscreen-related outcomes were most strongly associated with affective likelihood. Affectively-laden beliefs might be stronger predictors of some cancer-related behaviors than traditional cognitive likelihood measures. Including affective aspects of health risk

beliefs in health behavior interventions and theoretical models, including investigating their interrelationships in different behavioral contexts, could advance both theory and practice.

Keywords

Worry; Anticipated regret; Affect; Risk perception; Cancer prevention

Introduction

One of the central prerequisites for engaging in health-related behaviors is that people need to consider themselves at risk for a particular health threat. This assumption is fundamental in many health behavior theories (i.e., the Health Believe Model; Janz & Becker, 1984 and the Protection Motivation Theory; Rogers, 1975) and in research explaining cancer preventive behaviors (e.g., sunscreen use and smoking cessation; de Vries et al., 2005; Norman et al., 1999). Many studies operationalize risk beliefs as a single cognitive construct that focuses on relatively deliberative judgments of the likelihood or probability of a particular health threat (e.g., Waters et al., in press). However, early research emphasized the rich, multidimensional nature of beliefs about health risks (Slovic et al., 1980).

Modern theoretical perspectives suggest that beliefs about health risks include affectively-laden aspects that are important in explaining health behavior. As described in the self-regulation model of illness cognition and behavior (Cameron, 2003) and the risk as feelings framework (Loewenstein et al., 2001), this includes immediate visceral reactions to a hazard such as worry and anxiety (i.e., *anticipatory emotions*). However, *anticipated emotions* (i.e., emotions one expects to experience in the future) such as feelings of regret or disappointment are also important for feelings of risk (Loewenstein et al., 2001). The affect heuristic also explicitly identifies affective feelings as integral components of risk beliefs (Finucane et al., 2000); these feelings are thought to be comprised of both viscerally-experienced and anticipated emotions (Bechara et al., 1997; Damasio, 1994; Slovic et al., 2002).

The most commonly investigated affectively-laden aspects of beliefs about health risks are *affective likelihood* (i.e., how people report *feeling* about their risk, rather than their cognitive likelihood judgments), *worry* (i.e., people's concerns about a particular risk), and *anticipated regret* (i.e., how regretful people think they would feel when imagining a disease to occur because of their risk behavior). These variables have been associated with such diverse health-related behaviors as mammography screening (Hay et al., 2006; Lechner et al., 1997), influenza vaccination (Chapman & Coups, 2006; Weinstein et al., 2007), sunscreen use (Janssen et al., 2012), smoking cessation (Dijkstra & Brosschot, 2003), and colon cancer screening intentions (Dillard et al., 2012).

Although cognitive and affectively-laden beliefs about health risks (hereafter referred to as "cognitive risk beliefs" and "affective risk beliefs") are correlated, they are conceptually distinct and operate independently in explaining health behavior (Janssen et al., 2012; Moser et al., 2007; Schmiedege et al., 2009). Whereas cognitive risk beliefs are often considered deliberative assessments of the likelihood or probability of a health hazard occurring,

affective risk beliefs include the emotions and feelings surrounding the hazard (Klein et al., 2011; Sjöberg, 1998).

Recent studies suggest that affective risk beliefs may be more strongly related to health behavior than cognitive risk beliefs. Affective likelihood judgments have been found to be stronger predictors of behavior than cognitive likelihood judgments for such disparate outcomes as engaging in sun protection behaviors (Janssen et al., 2012), obtaining influenza vaccination (Weinstein et al., 2007), and intending to engage in colon cancer screening (Dillard et al., 2012). Furthermore, Chapman and Coups (2006) found that both worry and anticipated regret were stronger predictors of influenza vaccination compared to cognitive likelihood beliefs. Worry also prompted more motivation to quit smoking (Magnan et al., 2009). However, despite this growing body of research, studies that examine the relative influence of cognitive and affective aspects of risk beliefs in predicting health behavior is still in its infancy. Research comparing the different affectively-laden aspects of risk beliefs is even more limited [but see Weinstein et al. (2007)].

The aim of the present study was to examine the prospective influence of people's cognitive and affectively-laden beliefs about health risks on two very different cancer-related behaviors: tobacco use and sun protection. We hypothesized affective risk beliefs to be stronger predictors of health behavior compared to cognitive beliefs. Since research investigating the relative importance of different affective risk beliefs is in its infancy, no hypotheses were formulated about the predictive value of each individual affective belief. Hence, these analyses were exploratory in nature and intended to generate hypotheses for future research. The outcome variables were intentions and behavior related to making a smoking cessation attempt and using sunscreen while engaging in winter sports activities. We assessed cognitive risk beliefs using a cognitive measure of likelihood judgments, which is consistent with much of the current literature. Affective risk beliefs were assessed using measures of affective likelihood, worry, and anticipated regret.

The literature has not yet determined the fundamental nature of anticipated regret. Researchers have conceptualized it as an (affective) aspect of attitudes (Lechner et al., 1997), as a construct distinct from affective attitudes (Sandberg & Conner, 2008), and as a personal norm (Stradling & Parker, 1997). However, as described previously, anticipated emotions such as regret are often considered to be integral components of risk beliefs that influence health-related judgments, decisions, and behaviors (Loewenstein et al., 2001; Slovic et al., 2002; Weinstein et al., 2007). It is beyond the scope of this paper to resolve this complex issue. Nevertheless, based on empirical research supporting the importance of anticipated emotions for risk judgments (Bechara et al., 1997; Damasio, 1994), we will treat anticipated regret as an affectively-laden risk belief.

To the best of our knowledge, no other studies have compared cognitive risk beliefs with multiple, affectively-laden risk beliefs in the context of two cancer-related behaviors. These insights could have important implications for cancer risk communication practices by indicating the relative importance that should be placed on people's cognitive or affective risk beliefs. Furthermore, explicating these issues will help researchers clarify the choices

they must make when measuring risk beliefs in situations where time and survey space are limited (e.g., in clinical and community settings).

Method

Respondents and procedure

Data were obtained from two longitudinal surveys conducted in the Netherlands. Study 1 focused on tobacco use and was conducted between December 2009 and February 2010. Study 2 focused on sun protection during winter sports and was conducted between November 2009 and March 2010. The study samples consisted of Dutch adults. Participants in Study 1 were smokers who participated in an evaluation study that examined the effects of a mass media campaign on smoking cessation (van Kann et al., 2010). Smokers were recruited through an online internet panel of the private research company “TeamVier” (<http://www.teamvier.nl/nl/>), which consists of approximately 22,000 members. From this panel, a representative sample of 9,250 members (smokers *and* non-smokers) was invited to participate in this study. The first question asked about smoking status. Individuals who reported not smoking were told that they were not eligible and were excluded. A total of 1,174 smokers completed the baseline questionnaire and 914 smokers completed both questionnaires (77.9 % of those who filled in the baseline questionnaire). In order to stimulate participation in the follow-up survey, three reminders were sent over a 3 week period. Moreover, participants received a small incentive after completing the questionnaire(s) in the form of points which can be converted in a voucher of their choice. This study included only daily cigarette smokers (including rolling tobacco); cigar and pipe smokers were excluded. This resulted in 1,088 smokers at baseline and 843 smokers at follow-up.

For the analyses reported here, the effects of the campaign on risk beliefs were not assessed. Rather, we examine the extent to which baseline cognitive and affective risk beliefs explain baseline intention to quit smoking and making a 24-h quit attempt within the subsequent month, controlling for campaign exposure.

Participants in Study 2 were people who planned to go on a ski holiday. Recruitment took place by advertisements on popular ski websites (e.g., www.snowrepublic.com). Participants were asked to complete an online questionnaire before and after their trip. Each questionnaire included a definition of adequate sunscreen use (Dutch Cancer Society, 2007). The average period between baseline and post measurement was 45 days. A total of 491 respondents completed the baseline questionnaire and 436 respondents completed both questionnaires (88.8 % of those who filled in the baseline questionnaire). Respondents were entered into a lottery that provided the opportunity to win one of several gift vouchers ranging in value between €10 and €150.

Measures

The baseline questionnaires for both studies included measures of perceived cognitive likelihood, perceived affective likelihood, worry, anticipated regret, intentions, and relevant demographic variables. The follow up surveys included measures assessing campaign

exposure and whether participants made a 24-h quit attempt (Study 1), and sunscreen use (Study 2). Several other psychosocial variables were assessed in both studies, including attitudinal variables and social influence factors. Campaign process evaluation questions were assessed in Study 1. These questions were not included in the present analyses because they were outside the scope of the research question of interest. The full questionnaires can be obtained from the first author.

Cognitive likelihood was assessed with three questions in both studies ($\alpha = .90$, $\alpha = .82$ for Study 1 and 2 respectively; Janssen et al., 2012; Weinstein et al., 2007). Consistent with foundational health behavior theories and later methodological recommendations (Becker, 1974; Rogers, 1975; van der Pligt, 1998), the cognitive likelihood questions were conditioned on not performing the adaptive behavior. This also prevents people from inferring their likelihood estimate from their intentions to change behavior, which could lead to an underestimation of the relationship between perceived likelihood and health behavior (e.g., Brewer et al., 2007; Janssen et al., 2011). To ensure that the difference between cognitive and affective likelihood questions was clear, a short message was placed just prior to the cognitive likelihood questions. It emphasized that the subsequent questions were related to the *facts* about participants' likelihood of developing lung/skin cancer. Participants were asked questions such as: "If I keep smoking/do not protect my skin adequately from the sun using sunscreen, my chances of getting lung/skin cancer at some point in my life are..." ($1 = \text{very low}$; $5 = \text{very high}$).

Affective likelihood was assessed with three questions in the first study and six questions in the second study ($\alpha = .85$, $\alpha = .91$ for Study 1 and 2 respectively; Janssen et al., 2012; Weinstein et al., 2007; Windschitl, 2003). As with the cognitive likelihood measures, questions assessing affective likelihood were conditioned on not performing the behavior. A brief message also introduced the affective likelihood questions to emphasize participants should focus on their *intuitive feelings* about their likelihood of getting lung/skin cancer instead of their objective likelihood beliefs. Participants were asked such questions as: "If I keep smoking/do not protect my skin adequately from the sun using sunscreen, I feel..." ($1 = \text{definitely not vulnerable to getting lung/skin cancer at some point in my life}$; $5 = \text{very vulnerable to getting lung/skin cancer at some point in my life}$).

Worry was assessed with three questions in both studies ($\alpha = .87$, $\alpha = .70$ for Study 1 and 2 respectively; Cameron, 2008; McCaul & Goetz, 2008). Participants were asked, for example, "How worried are you about getting [lung/skin] cancer?" ($1 = \text{not at all}$; $5 = \text{extremely}$).

Anticipated regret was assessed with one question in both studies. The item was adapted from Ziarnowski and colleagues (2009) and asked participants, "How much regret would you feel if you were to get [lung/skin] cancer in the near future because of your smoking/inadequate sunscreen use?" ($1 = \text{little regret}$; $5 = \text{much regret}$).

Intention to quit smoking in Study 1 was measured with two items ($\alpha = .88$; Dijkstra et al., 1998). Participants were asked, "Do you intend to quit smoking?" and "Are you motivated to quit smoking?" ($1 = \text{definitely not}$; $5 = \text{definitely}$).

Intention to use sunscreen in Study 2 was measured by one question (de Vries et al., 2006) asking respondents, “Do you intend to use sunscreen adequately during your upcoming winter sports holiday?” (*1 = definitely not; 5 = definitely yes*).

Twenty-four-hour quit attempt in Study 1 was assessed with two questions (Mudde et al. 2000). Participants were asked, “Did you try to quit smoking during the past month?” and (if yes) “Did you succeed in abstaining from smoking for 24 h or longer?” (*1 = not performed 24-h quit attempt; 2 = performed 24-h quit attempt*).

Sunscreen use in Study 2 was assessed by one question (Janssen et al., 2011) asking participants, “To what extent did you use sunscreen adequately during your ski holiday” (*1 = never; 5 = always*).

Background variables that were assessed in both studies were gender, age and educational level. In Study 1, we also assessed the average number of cigarettes/rolled tobacco smoked daily and campaign exposure (i.e., whether respondents recognized at least one of the campaign elements). In Study 2, we also assessed skin sensitivity (*1 = skin burns very rapidly and does not (or rarely) tan to 4 = skin rarely burns and tans very well*) using guidelines from the Dutch Cancer Society (Dutch Cancer Society, 2007).

Statistical analysis

Descriptive statistics were used to describe background variables within the study samples. To examine the additional contribution of affective risk beliefs, hierarchical linear regression analyses (i.e., for intention and sunscreen use as dependent variables) and logistic regression analyses (i.e., for 24-h quit attempt as the dependent variable) were performed. Background variables were entered in the first block, the cognitive risk beliefs in the second block and the affective risk beliefs in the third block. For behavioral outcomes, a fourth block included intentions. Analyses were conducted using SPSS version 17.0 and statistical significance was defined as $p < .05$.

Results

Sample characteristics

Characteristics of the study samples are depicted in Table 1. The gender distribution was almost equal in Study 1 with 52 % females. Study 2 consisted of 58 % females. Participants were, on average, 44 years in Study 1 and 31 years in Study 2. In Study 1, 32 % of the participants had only primary school or basic vocational training, 46 % had high school or secondary vocational training, and 23 % had university or higher vocational training. In Study 2, 5 % of the respondents had primary school or basic vocational training, 47 % had high school or secondary vocational training, and 48 % had university or higher vocational training.

Correlational analyses

Correlations among the study variables are presented in Table 2. Medium to strong correlations (Cohen, 1988) among the risk beliefs were found in Study 1 (tobacco use; $r = .42$ to $.73$) and medium to strong correlations were found in Study 2 (sunscreen use; $r = .31$

to .54). Medium correlations between intentions and risk beliefs were found in Study 1 (tobacco use; $r = .36$ to $.45$), and small to medium correlations were found in Study 2 (sunscreen use; $r = .25$ to $.47$). Small correlations between behavior and risk beliefs were found in Study 1 (tobacco use; $r = .10$ to $.16$, and small to medium correlations were found in Study 2 (sunscreen use; $r = .20$ to $.40$).

Regression analyses

The results of the linear and logistic regression analyses for Study 1 (tobacco use) are presented in Table 3, and the results of the linear regression analyses for Study 2 (sunscreen use) are presented in Table 4.¹

Intentions to quit smoking—The first step shows that being younger, having more education and smoking fewer cigarettes per day were associated with stronger smoking cessation intentions. In step 2, cognitive likelihood was also associated with stronger intentions. However, when affective risk beliefs were added (step 3), the independent contribution of cognitive likelihood vanished. Rather, higher affective likelihood, higher worry and higher regret were each independently associated with stronger smoking cessation intentions.

Making an attempt to quit smoking—Step 1 shows that smoking fewer cigarettes per day was associated with having made a 24-h quit attempt. Step 2 shows that higher cognitive likelihood was also associated with having made a 24-h quit attempt. However, adding the three affective risk belief variables in step 3 eliminated the independent contribution of cognitive likelihood. Of these three variables, anticipated regret was the only significant correlate of having made a 24-h quit attempt. Step 4 revealed that stronger smoking cessation intentions were associated with having made a 24-h quit attempt.

Intentions to use sunscreen—Being female, being older and having a more sensitive skin type were associated with higher sunscreen use intentions (step 1). Step 2 showed that higher cognitive likelihood beliefs were associated with higher sunscreen use intentions. Step 3 demonstrated that affective likelihood and anticipated regret were also associated with higher sunscreen use intentions.

Sunscreen use behavior—Being female, being younger and having a more sensitive skin type were associated with sunscreen use in step 1. In step 2, higher cognitive likelihood beliefs also predicted more sunscreen use. However, when controlled for affective risk beliefs in step 3, no independent contribution of cognitive likelihood was found. Affective likelihood was the only affective risk belief that correlated significantly with sunscreen use.

¹Additional exploratory analyses were conducted to investigate interactions between the cognitive and affective risk beliefs. Of the 24 tested interactions, the only significant ($p < .05$) interaction found was between affective likelihood and anticipated regret for making an attempt to quit smoking. Due to the large number of statistical tests conducted, it is important to replicate this finding before drawing any definitive conclusions about its meaning. Exploratory post hoc analyses revealed that, compared to participants who reported low scores on both affective risk belief variables, those who reported high scores on either or both variables were more likely to make a quit attempt. Although reporting high levels of both affective variables appeared to elicit slightly more quit attempts than reporting high levels of only one affective variable, the difference was not statistically significant. The possible combined influence of multiple versus one affective risk belief variables should be examined in future experimental research that is designed to test this question explicitly.

Step 4 demonstrated that higher affective likelihood beliefs and intentions were positively associated with sunscreen use.

Incremental significance—Importantly, for both studies, each step produced a significant increase in the amount of variance accounted for by the model based on the F change or χ^2 statistic, as appropriate. This was true for intentions and actual behavior.

Discussion

In an effort to inform cancer risk communication practices and to help researchers make judicious decisions about the measurement of beliefs about health risks, the present study investigated the influence of cognitive and affectively-laden beliefs about health risks in the context of two cancer preventive behaviors: tobacco use and sun protection.

The results revealed that these cancer-related intentions and behaviors were associated primarily with affective risk beliefs. Although cognitive likelihood judgments were associated with intentions and behavior, examining their relationships in conjunction with affective risk beliefs produced a very different message. Specifically, cognitive risk beliefs predicted intentions only for intention to use sunscreen, not intentions to quit smoking or actual tobacco or sun protection behaviors. However, even this single contribution was small relative to the contribution of the affective risk beliefs. These results suggest that affective risk beliefs might be more important than cognitively-oriented risk beliefs for some cancer preventive behaviors. This conclusion is consistent with the findings of previous studies, which demonstrated that affective risk beliefs were stronger predictors of health behavior compared to cognitive beliefs (Chapman & Coups, 2006; Dillard et al., 2012; Janssen et al., 2012; Weinstein et al., 2007). It is also consistent with several theoretical perspectives emphasizing the important role of affect in the decision making process (e.g., Loewenstein et al., 2001; Slovic et al., 2005).

The results further indicate that, of the three affective risk beliefs, anticipated regret was associated more strongly with tobacco use, whereas affective likelihood was associated more strongly with sun protection. This is consistent with recent research showing that different types of affective risk beliefs can explain unique variance over and above that provided by cognitive beliefs (Janssen et al., 2012; Lazuras et al., 2012). However, those studies included only one affective risk belief each (i.e., affective feelings (Janssen et al., 2012) and anticipated regret (Lazuras et al., 2012)).

These results also suggest that different types of affectively-laden beliefs about risk might be related to different behaviors in different ways. For example, decades of public health messaging has informed smokers about the importance of quitting smoking, and most smokers acknowledge that smoking can cause severe health problems (Weinstein et al., 2004). In addition, the vast majority of smokers wish they had never started smoking and have made several unsuccessful quit attempts (Jarvis et al., 2002; Slovic, 2000). Because many smokers struggle with a behavior they wish they could stop, anticipating feeling regret about experiencing a severe negative health consequence because of their smoking may be particularly motivating in terms of making a quit attempt. People going on a winter ski

holiday, on the other hand, may not have such direct and visceral experiences to draw upon. Consequently, their feelings of anticipated regret may not have the same degree of influence. An alternative explanation for the stronger link between anticipated regret and smoking cessation versus sunscreen use could be because lung cancer is a more deadly health threat than skin cancer.

In contrast to two studies of influenza vaccination (Chapman & Coups, 2006; Weinstein et al., 2007), worry did not provide an independent contribution to explaining quit attempts and sunscreen use. However, in addition to targeting different behavioral domains, the abovementioned studies did not control for behavioral intentions, nor did they include all three affectively-laden risk beliefs included in the present research. Another potential reason for the finding is that this study used unconditional measures of worry (i.e., no behavioral condition was included in the questions) in contrast to the cognitive and affective likelihood questions. Unconditional worry measures are common in the current literature (e.g., Cameron, 2008; McCaul et al., 1996). However, we cannot preclude the possibility that conditional worry questions may yield differential results, because general beliefs tend to correlate less strongly with specific behaviors (Ajzen & Timko, 1986).

Because this is the first study exploring the relationships of three different affectively-laden risk beliefs on cancer related behaviors, replication of the present findings is warranted. Ideally, such a replication would use an experimental design to manipulate these beliefs (e.g., Hall et al., 2009; Magnan et al., 2009). It has been proposed that, compared to disease prevention behaviors, disease detection behaviors may be more likely to be associated with affective responses (Millar & Millar, 1993). Many published studies on disease detection behaviors compare cognitive beliefs with only one affective belief (i.e., worry) (e.g., Moser et al., 2007). Therefore, it is important to include disease detection behaviors in future experimental research.

The inter-relationships among the three affectively-laden risk beliefs and their underlying mechanisms should also be examined. Because affective risk beliefs were not significantly associated with behavior in Study 1 (tobacco use) when controlled for baseline intentions, but affective likelihood remained important for Study 2 (sun protection), the circumstances under which affective risk beliefs have direct versus mediated relationships with health behaviors should be explored. Moreover, the effects of cognitive likelihood on behavior vanished *after* including affective risk beliefs. Whether this represents a mediation effect should be examined in future research. Studies that identify the mechanisms of and inter-relationships among risk beliefs can advance theoretical knowledge by incorporating the research findings into existing models that include risk beliefs, yet operationalize them as cognitive likelihood judgments (e.g., Protection Motivation Theory; Rogers, 1975, Health Belief Model; Janz & Becker, 1984). The results of the current study combined with future research investigating interrelationships in more detail might, for example, help to refine these theories by suggesting new measures to be included (e.g., anticipated and anticipatory emotions) and by generating hypotheses about how different types of risk beliefs relate to each other.

These advances in the ability to describe, explain, and predict health behavior will not only advance basic theoretical knowledge, but will also provide practical public health applications. Interventions that target affective risk beliefs, such as those that communicate risk via narratives or images (Dillard et al., 2010; Lee et al., 2011), may be more effective in changing behavior than those that focus solely on changing cognitions. The intervention development *process* may also benefit. Including measures of affective risk beliefs in the pilot studies that precede full-blown intervention testing may enable researchers to determine the relative effectiveness of different intervention components. Pilot-testing will be especially important, because best practices for influencing affective risk beliefs are scarce.

Finally, there is some debate about whether conditional risk beliefs should be considered as a specific construct or whether they are part of attitudinal and outcome expectancy beliefs. As was mentioned in the introduction, there is also inconsistency in the literature about the conceptualization of anticipated regret. It was beyond the scope of this paper to address these fundamental issues, but they remain important theoretical questions. In this context, it would also be interesting to consider the relative influence of affectively-laden risk beliefs when examined in conjunction with other important determinants of health behavior (e.g., social norms and self efficacy beliefs).

Limitations

Assessing affective likelihood beliefs in addition to cognitive likelihood beliefs is a relatively recent practice. Consequently, the best way is to formulate items that help participants distinguish between these two items is unclear. Like previous research, this study attempted to clarify this matter by providing a short introductory sentence that described the task to participants as focusing on “facts” versus “intuitive feelings” (Janssen et al., 2012; Windschitl, 2003; Baldwin & Windschitl, 2010). The question stem of the affective likelihood item also mentioned feelings. However, additional research is needed to identify the best strategy to ensure that these two components are interpreted as intended.

Although the analyses of the behavioral outcomes were prospective, the study used a correlational (rather than experimental) approach. Thus, readers should be cautious in the extent to which they infer causality with respect to the relationships described in the current research. Further, the affective likelihood scale in Study 2 consisted of more items compared to the scale of the other risk beliefs. The stronger associations for affective likelihood in Study 2 might therefore be related to a better reliability of the measurement instrument. However, analyses including only the first three items of affective likelihood, which is in accordance with the number of items used to assess cognitive likelihood and worry, showed the same results as presented in this paper. Furthermore, single-item measures were used to assess anticipated regret; it could be that including more items would improve the reliability and predictive validity of this belief.

Implications

Our findings underscore the importance of affectively-laden beliefs about health risks in the context of tobacco use and sun protection. These results add to the growing body of

evidence suggesting that affective risk beliefs might be stronger predictors of certain preventive behaviors than traditional cognitive likelihood beliefs (e.g., Magnan et al., 2009; Weinstein et al., 2007). Although some health behavior theories acknowledge the importance of affect (e.g., Witte, 1992), those that do not would likely benefit from incorporating affectively-laden beliefs into their frameworks (e.g., Janz & Becker, 1984).

Risk communication research and practice would also benefit from considering the affective aspects of beliefs about health risks. In situations where time and survey space is limited, the inclusion of affective risk beliefs might be preferable to cognitive risk beliefs. Differences in associations among the three affective risk beliefs across the two preventive behaviors suggest that their influence might be behavior-dependent. Investigating these interrelationships further and using the findings to develop and implement novel health behavior interventions might have a significant positive impact on public health.

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Table 1

Characteristics of the sample

	Study 1 (tobacco use)	Study 2 (sunscreen use)
<i>N</i>	1,088	491
Gender		
% women	51.8 %	57.8 %
Mean age (SD)	44.1 (12.54)	31.2 (12.87)
Education		
% primary school or basic vocational training	31.6 %	4.7 %
% high school or secondary vocational training	45.7 %	46.8 %
% university or higher vocational training	22.6 %	48.4 %
Skin type		
% skin type 1–2 (low sensitivity)		50.7 %
% skin type 3–4 (high sensitivity)		49.3 %
Campaign exposure		
% exposed	69.0 %	
24 h quit attempt		
% yes	12.5 %	
Mean number of cigarettes (SD)	16.7 (8.61)	
Mean sunscreen use (SD) ^a		3.3 (1.23)
Mean intention (SD) ^a	3.2 (1.14)	4.0 (0.99)
Mean cognitive likelihood (SD) ^a	3.4 (0.74)	3.7 (0.73)
Mean affective likelihood (SD) ^a	3.2 (0.80)	3.3 (0.77)
Mean worry (SD) ^a	2.8 (0.87)	2.7 (0.70)
Mean anticipated regret (SD) ^a	3.3 (1.15)	4.0 (0.95)

^a Scores on these variables range from 1 (lowest levels of use, intentions, likelihood judgments, worry, and regret) to 5 (highest levels of use, intentions, likelihood judgments, worry, and anticipated regret)

Table 2

Pearson and spearman^a correlations between study variables

		Study 1 (Tobacco Use)				
Study 2 (Sunscreen Use)		Cognitive likelihood	Affective likelihood	Worry	Anticipated regret	Intention
						Behavior
	Cognitive likelihood ^b		.73**			
	Affective likelihood	.54**		.58**	.42**	.36**
	Worry	.37**	.52**	.73**	.52**	.45**
	Anticipated regret	.32**	.39**		.62**	.43**
	Intention	.33**	.47**	.25**	.28**	.44**
	Behavior	.24**	.40**	.22**	.20**	.50**

**
 $p < .01$ ^a Spearman correlations were calculated between the behavioral outcome (24-h quit attempt: yes-no) and risk beliefs in Study 1^b Correlations for Study 1 (tobacco use) are unshaded and located above the diagonal. Correlations for Study 2 (sunscreen use) are shaded and located below the diagonal

Table 3

Regression analyses for Study 1 (tobacco use)

Variable ^b	Intention (N = 1,088)		24-h quit attempt at 1 month follow-up ^d (N = 843)	
	β	R^2 (F) ^c	OR	R^2 (χ^2) ^c
Step 1				
Gender (1 = male; 2 = female)	.01	.04 (F = 10.57 ^{***})	.78	.05 ^d (χ^2 = 22.30 ^{***})
Age	-.10 ^{**}		.99	
Education	.09 ^{**}		1.10	
Number of cigarettes	-.10 ^{**}		.95 ^{***}	
Campaign exposure (1 = non exposed; 2 = exposed)			1.14	
Step 2				
Gender	-.04	.16 (F = 150.22 ^{***})	.73	.08 (χ^2 = 12.24 ^{***})
Age	-.06 [*]		1.00	
Education	.09 ^{**}		1.09	
Number of cigarettes	-.13 ^{***}		.95 ^{***}	
Campaign exposure			1.11	
Cognitive likelihood	.35 ^{***}		1.74 ^{**}	
Step 3				
Gender	-.08 ^{**}	.28 (F = 61.25 ^{***})	.64	.11 (χ^2 = 13.40 ^{**})
Age	-.06 [*]		1.00	
Education	.09 ^{**}		1.09	
Number of cigarettes	-.09 ^{**}		.95 ^{***}	
Campaign exposure			1.10	
Cognitive likelihood	.05		1.32	
Affective likelihood	.21 ^{***}		.96	
Worry	.09 [*]		1.17	
Anticipated regret	.25 ^{***}		1.42 ^{**}	
Step 4				
Gender			.72	.22 (χ^2 = 54.47 ^{***})
Age			1.00	
Education			1.06	
Number of cigarettes			.95 ^{**}	
Campaign exposure			.97	
Cognitive likelihood			1.09	
Affective likelihood			.78	
Worry			1.11	
Anticipated regret			1.23	
Intention			2.77 ^{***}	

*
 $p < .05$;

**
 $p < .01$;

 $p < .001$

^a Out of the 843 participants in Study 2, 105 (12.4 %) made at least one 24-h quit attempt; 738 did not

^b Gender was coded as 1 (male) and 2 (female); Education range from 1 (primary school) to 7 (university); Campaign exposure was coded as 1 (non exposed) and 2 (exposed), and scores on likelihood judgments, worry, regret, and intentions range from 1 (lowest levels of intentions, likelihood judgments, worry, and regret) to 5 (highest levels of intentions, likelihood judgments, worry, and anticipated regret)

^c The significance of adding additional variables in each step was determined by the F change statistic (for the regression analyses for intentions to quit smoking) and the χ^2 statistic (for the logistic regression analyses for making a quit attempt)

^d Nagelkerke R square was used as the R^2 estimate in the logistic regression analysis

Table 4

Regression analyses for Study 2 (sunscreen use)

Variable ^a	Intention (N = 491)		Sunscreen use at follow-up (average 45 days) (N = 436)	
	β	R^2 (F) ^b	β	R^2 (F) ^b
Step 1				
Gender (1 = male; 2 = female)	.18***	.11 (F = 14.48***)	.23***	.13 (F = 16.47***)
Age	.24***		.25***	
Education	.02		.01	
Skin type (1 = most sensitive, 4 = least sensitive)	-.13**		-.14**	
Step 2				
Gender	.10*	.18 (F = 42.88***)	.19***	.16 (F = 12.78***)
Age	.24***		.25***	
Education	.02		.01	
Skin type	-.08		-.12*	
Cognitive likelihood	.28***		.17***	
Step 3				
Gender	.04	.28 (F = 21.71***)	.15**	.22 (F = 11.11***)
Age	.19***		.20***	
Education	-.00		.00	
Skin type	-.04		-.08	
Cognitive likelihood	.10*		.01	
Affective likelihood	.33***		.30**	
Worry	-.03		-.02	
Anticipated regret	.13**		.04	
Step 4				
Gender			.13**	.32 (F = 63.35***)
Age			.11**	
Education			.01	
Skin type			-.07	
Cognitive likelihood			-.02	
Affective likelihood			.19**	
Worry			-.01	
Anticipated regret			-.02	
Intention			.37***	

* $p < .05$;** $p < .01$;*** $p < .001$

^a Gender was coded as 1 (male) and 2 (female); Education range from 1 (primary school) to 7 (university); Skin type range from 1 (most sensitive) to 4 (least sensitive), Campaign exposure was coded as 1 (non exposed) and 2 (exposed), and scores on likelihood judgments, worry, regret, and intentions range from 1 (lowest levels of intentions, likelihood judgments, worry, and regret) to 5 (highest levels of intentions, likelihood judgments, worry, and anticipated regret)

^b The significance of adding additional variables in each step was determined by the *F* change statistic